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A Memorial

By H. W. TYLER

Reprinted from the Technology Review, Vol. IV, No. 3

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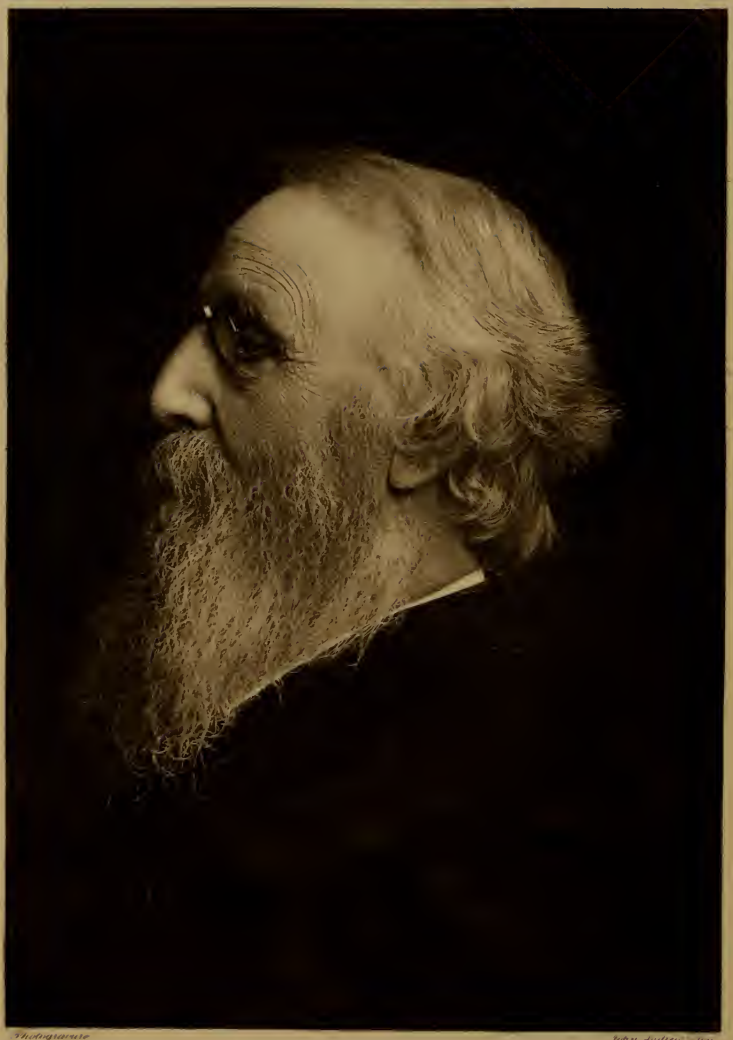

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S.B., A.M., Harvard, 1851; Ph.D., Hamilton, 1867; LL.D., Wesleyan, 1871.
Professor of Mathematics, 1865–1902; Acting President, 1868–1870; President, 1870–1878.

John D. Runkle was born at Root, N.Y., and died at Southwest Harbor, Me., near the close of his eightieth year. More than half of his long life was devoted to the creation and upbuilding of the Massachusetts Institute of Technology, of which, next to President Rogers, he was the chief founder. It is a forcible reminder of the brevity of our corporate existence that it dates only from the middle age of our friend who but yesterday was with us. A review of the Institute's life is a review of the later chapters of his own.

As a boy, he led the self-helpful life of the farm, heavily handicapped in the struggle for education, but none the less certain of ultimate success. Not until 1847 did he enter college, the newly established Lawrence Scientific School of Harvard University. His name stands alone in

*The writer of this paper is indebted to the excellent account of Professor Runkle's life contained in the *Technique* of the class of 1901. The effective researches on which it was based make it a valuable contribution to the history of the Institute.

the catalogue of 1848–49 as "student in mathematics." Edward Everett was President; the Faculty of the Scientific School included Eben N. Horsford as Dean, Benjamin Peirce, Louis Agassiz, Asa Gray, Jeffries Wyman, Joseph Lovering, J. W. Webster, and the Bonds. John W. Draper and James E. Oliver were fellow-students; Josiah P. Cooke and William T. Harris, resident graduates. No diploma was offered, but certificates of the number of terms of attendance and of the studies pursued were given. The number and choice of studies were optional. Attendance was voluntary. "The government of the University wish wholly to discourage the resort of young men to the Scientific School who do not possess that stability of character and firmness of purpose which will insure a faithful performance of duty without academic discipline." Runkle was a member of the first graduating class, of 1851, with Joseph Le Conte and David A. Wells. He received the degree of Bachelor of Science, and at the same time, for high scholarship, the honorary degree of Master of Arts. It is interesting that Runkle, after his own graduation, brought two of his four younger brothers to Harvard.

At the middle of the last century, scientific work in the United States was limited alike in scope and in estimation. The colleges — as well as those called universities — naturally included mathematics in their curricula, though only of an elementary sort, ending with a simple treatment of the calculus. The physical and natural sciences, if not excluded, were in general presented as "information courses," with no possibility of adequate appreciation, except in the occasional case of a student of native genius having the good fortune to secure close relations with an inspiring teacher. Astronomy was, in some measure, an exception. As then understood, it had reached a relatively

high degree of completeness, in the sense that its observed phenomena had been mathematically correlated and made the basis of accurate prediction. At the same time the familiarity of these phenomena, the magnificence of some of them, the overwhelming magnitudes of space and time, stimulated the imagination of the educated public, and developed a degree of popular interest shared only in limited measure by the sister science, geology. It is interesting to note that Rogers came to his Institute work in general applied science through geology, as Runkle came through mathematical astronomy.

It is often not appreciated how modern a development is the science of pure mathematics. The boundary line between pure and applied mathematics is indeed — and fortunately — a vague and shifting one. It may be said that the distinction is mainly subjective, corresponding to diverse attitudes and aims of students of the science. Objectively, pure mathematics is a science based on processes of abstract thinking. Applied mathematics is the corresponding quantitative treatment of concrete phenomena. The pure mathematics of to-day is applied to-morrow or the day after. In 1850 the great researches of the European mathematicians of the preceding half-century were little known in this country. Our own scholars of mathematical bent naturally gravitated into mathematical astronomy,— thus Benjamin Peirce and many of his students.

In this connection it may be remarked that in the preface of his treatise on Analytic Mechanics in 1855, Peirce states that he has been induced to undertake its publication "at the request of some of my pupils, and especially of my friend, Mr. John D. Runkle."

The work of computation for the Nautical Almanac was carried on at this time in Cambridge by a staff including,

among other men of subsequent eminence, Simon Newcomb, Asaph Hall, George W. Hill, T. H. Safford, and J. M. Van Vleck. Mr. Runkle's connection with the Almanac began in 1849, and continued in some form as late as 1884.

In 1858 Mr. Runkle founded the *Mathematical Monthly* on the basis of replies received in response to the following letter, addressed to many of the most eminent mathematicians and educators in the various parts of the United States: —

NAUTICAL ALMANAC OFFICE, CAMBRIDGE, February 13, 1858.

Dear Sir,— Allow me to call your attention to the following considerations: You are aware, that, while almost every science, as well as art, has its own appropriate journal, around which corresponding interests and tastes cluster, by which special research is encouraged, and through which all the valuable results are communicated to the world, the science of Mathematics is still without its own particular organ.

Now it seems to us that such a journal is needed; one that shall embrace, among its contributors, the best talent, in order that younger laborers in the same field may always have before them a high standard of excellence, and that it may be a fair index of the mathematical ability of the country. On the other hand, however, care should be taken not to graduate it, as a whole, too high above the average attainments of mathematical students: otherwise, only the few would be interested in it or benefited by it. It should therefore embrace in its pages solutions, demonstrations, and discussions in all branches of the science, as well as in all its various applications.

It should contain notes and queries, notices and reviews of all the principal mathematical works issued in this country as well as in Europe.

In short, it should be the medium of all kinds of information pertaining to the science, to which a large proportion of our mathematical students have at present no ready access.

Such is, in brief, our idea of the character the journal should possess to insure to it the greatest usefulness and most permanent success. . . . With much esteem,

Yours truly,

J. D. Runkle.

Encouragement was received and formal indorsement was given by the American Association for the Advancement of Science and by several educational bodies.

The list of contributors included many distinguished names, among others Arthur Cayley, William Chauvenet, George W. Hill, Simon Newcomb, Benjamin Peirce, John Herschel.

In the "Teaching and History of Mathematics in the United States," Cajori says: —

The time for beginning the publication of a long-lived mathematical journal was not opportune. Three volumes only appeared. On a fly-leaf the editor announced to his subscribers that over one-third of the subscribers to Volume I. discontinued their subscriptions at the close. "I have supposed," he says, "that those who continued their subscription to the second volume would not be so likely to discontinue it to the third volume, and I have made my arrangements accordingly. If, however, any considerable number should discontinue now, it will be subject to very serious loss. . . . I ask as a favor for all to continue to Volume III., and notify me during the year if they intend to discontinue at its close. I shall then know whether to begin the fourth volume. I shall not realize a dollar." This announcement discloses obstacles which all our journals that have been dependent entirely upon their subscribers for financial support have had to encounter, and which none except the more recent could long resist. Moreover, the Civil War was now at hand. On account of the present disturbed state of public affairs the publication of the *Mathematical Monthly* was discontinued.

The foundation of the Massachusetts Institute of Technology, like most notable forward movements, was largely due to the enthusiasm of young men; and the statement does not lose its fundamental significance if it be added at once that youth may designate an attribute of temperament rather than mere fewness of years.

Professor William Barton Rogers came to Boston in 1853, — in his forty-ninth year,— bringing with him not indeed a matured plan for an Institute of Technology, but rather that enthusiasm, insight, breadth of scientific attainment, skill in popular exposition, and fitness for leadership which enabled him to organize success.

He occupied himself in writing and lecturing on scientific subjects, and became the natural leader of a group of enlightened citizens eager for the development of comprehensive plans for educational and scientific institutions in the land then being reclaimed from the tidal waters of the Back Bay. It would be interesting to follow the gradual crystallization of these plans from original relative vagueness into definite symmetry, and incidentally to trace the various influences of acquaintance with foreign institutions on the part of some of the persons co-operating in the general undertaking.

In February, 1859, a meeting was held of "individuals representing Associations of Agriculture, Horticulture, Art, Science, and various Industrial, Educational, and Moral Interests of the State," with a view to memorializing the legislature for a grant of land belonging to the Commonwealth, in aid of a plan for a conservatory of art and science, in line with a recommendation in the annual message of Governor Banks. The plan as elaborated aimed to present scientific information and collections in popular form to a large constituency.

Further progress of this effort up to 1860 is embodied in the "Objects and Plan of an Institute of Technology, including a Society of Arts, a Museum of Arts, and a School of Industrial Science," prepared by Professor Rogers. This exposition was sent to a considerable number of prominent persons, in anticipation of a meeting; and at the meeting a committee of twenty, to which Professor Rogers was added as chairman, was appointed to act generally in behalf of the proposed association, until it should be legally incorporated as the Massachusetts Institute of Technology. Mr. Runkle was a member of this committee, and during the subsequent preliminary steps his name continually recurs. His own review of these developments may be found in an address in memory of President Rogers before the Society of Arts in October, 1882.

In April, 1862, Mr. Runkle, as first Secretary of the Institute, notified Professor Rogers of his election as President of the Massachusetts Institute of Technology, to serve until the first annual meeting, at which time the government for the ensuing year would be elected. At this first annual meeting, Mr. Runkle was elected chairman of the Committee on Publication.

A further development of the embryo school is represented by the "Scope and Plan of the School of Industrial Science," prepared by President Rogers, adopted in May, 1864, and remaining since that time our "intellectual charter."

About this time, President Rogers writes that "with the aid of Professor Runkle and Dr. Watson, a graduate of the *Ponts et Chaussées*, I am framing a course of applied mathematics for our Institute, reaching from the very elements up to the fullest demands of the scientific engineer."

In January, 1865, Runkle writes to Rogers, discussing at

length the organization and plan of the new school, saying of the "Scope and Plan": "I am more than ever delighted with it. I have analyzed it with the greatest care, carrying in imagination students through each of the courses from year to year; and I find it to my mind perfect in all its parts." As to his extended list of professorships he adds: "It might be the best plan to appoint young men who would . . . grow up under your eye and direction." . . . The gradual fulfilment of the great ideal was henceforth his life purpose.

In February, 1865, the President and Professors Runkle and Watson began to meet their classes, the original Faculty including also Professors Storer in Chemistry and Bôcher in French and Mr. W. T. Carlton in Free-hand Drawing.

In October, 1868, the first class having been graduated but a few months before, President Rogers, on whom so much depended, was incapacitated by illness. At that time Professor Runkle was his chief lieutenant, with most cordial personal relations; and his prompt choice as Acting President, in accordance with President Rogers's expressed desire, was thus most natural and fitting. This appointment was held until 1870, a period including the election of Professor Eliot as President of Harvard University, the preparation by Professor Edward Pickering of detailed plans for a physical laboratory, and the failure of an application for State aid. Interesting glimpses of this period are afforded by the "Life and Letters" of President Rogers.

July 4, 1869, Professor Runkle writes to Mrs. Rogers with a foreshadowing of future development: —

> Last spring at the Academy I met Commodore Rodgers, and the idea occurred to me that perhaps, in some way, our students in this

department [Mechanical Engineering] might gain admission to the machine shop of the Navy Yard, during their long summer vacations, as volunteers. I suggested the idea to the commodore, who said it would give him the greatest pleasure to issue orders in favor of any students I should send him. Now Mr. Hall and three of our students in Mechanical Engineering are at work in the Yard with every advantage that that great shop can offer them. It virtually gives the Institute, without cost, a shop which it could not supply without a mint of money; and if the students do right, as I know they will, all future classes will have the same opportunity.

. . . But, my dear Mrs. Rogers, do not bring all these things to the attention of the President. They are my sleeping as well as waking thoughts, and I know that however much he might agree and sympathize with me in them, they would be far too exciting. His approbation is all the reward I ask; and at any rate he will always know that in all I do I have but one end, the good of the Institute, in view. . . .

In May, 1870, President Rogers, on account of continued ill-health, finally tendered his resignation of the Presidency, which was reluctantly accepted by the Corporation through a committee under the chairmanship of Dr. Runkle.

On the same day with his resignation, President Rogers wrote from Philadelphia: —

To the Government of the Massachusetts Institute of Technology:

Gentlemen,— In retiring from the Presidency of the Institute, I trust you will not deem me presumptuous in recommending Professor Runkle as my successor.

I know of no one who is more thoroughly familiar with the objects and spirit of its organization or who would better carry them out in its development. His faithful services and tried abil-

ity in administering the affairs of the Institute for the last two sessions appear to me eminently to fit him for this position; and, should he be your choice, I shall, in retiring, have the satisfaction of feeling that the Institute is in the charge of one who will bring experience as well as earnest zeal to its advancement. . . .

In the same year, as in a similar later exigency, proposals were received looking toward some connection between the Institute and Harvard University. The negotiations following were difficult, and necessarily involved no little embarrassment and responsibility for the Acting President and his associates. They met both with courage. Professor Runkle was elected President in spite of adverse influences. The integrity and independence of the Institute were preserved.

Dr. Runkle held the Presidency of the Institute from October, 1870, for eight years,— a period momentous for the school, momentous for himself. The situation was a most exacting one, making altogether exceptional demands. The school, only five years old, was in no condition to lose the guidance of its founder. It had not yet gathered the momentum necessary for steady, straightforward progress. Its general direction was indeed determined; but it was a ship sailing seas not well charted, with many chances of shipwreck even without a change of navigator. The new head must have wisdom, courage, sincerity, resolute initiative, but, above all, devoted, self-sacrificing loyalty. Opinions did and will differ as to President Runkle's judgment on the difficult questions that, as time passed, pressed overwhelmingly upon him for solution. No man could have been more devotedly loyal to the school or to its founder, his predecessor and ultimately his successor. None could have shown more steadfast courage, not only against heavy odds, but too often with but feeble support.

Any connected narrative of Dr. Runkle's Presidency would transcend the limits of this paper, but certain salient or significant elements may be noted.

The courses of instruction in 1868 were: Mechanical Engineering, Civil and Topographical Engineering, Chemistry, Geology and Mining, Building and Architecture, Science and Literature, all being identical for the first two years.

In 1878, Metallurgy, Natural History, Physics, and Philosophy had been added.

The Faculty of 1868 included, besides Acting President Runkle, William B. Rogers, Geology; Frank H. Storer, General and Industrial Chemistry; Charles W. Eliot, Analytical Chemistry and Metallurgy; Cyrus M. Warren, Organic Chemistry; William P. Atkinson, English Language and Literature; Ferdinand Bôcher, Modern Languages; John B. Henck, Civil and Topographical Engineering; William Watson, Descriptive Geometry and Mechanical Engineering; William R. Ware, Architecture; George A. Osborne, Astronomy and Navigation; Alfred P. Rockwell, Mining Engineering; Edward C. Pickering, Physics.

In 1878 Storer, Bôcher, and Pickering had followed Eliot to Harvard; Warren, Watson, and Rockwell had also resigned. New members of the Faculty included Samuel Kneeland, Zoölogy and Physiology; John M. Ordway, Metallurgy and Industrial Chemistry; James M. Crafts, Organic Chemistry; Robert H. Richards, Mining Engineering; Thomas Sterry Hunt, Geology; George H. Howison, Logic and the Philosophy of Science; William Ripley Nichols, General Chemistry; Charles P. Otis, Modern Languages; Charles H. Wing, Analytical Chemistry; Alpheus Hyatt, Palæontology; William H. Niles, Physical Geology and Geography; Channing Whitaker, Me-

chanical Engineering; Charles R. Cross, Physics and Descriptive Astronomy; Gaetano Lanza, Theoretical and Applied Mechanics; Henry W. Hubbell, Military Science and Tactics.

In 1868 one class of fourteen members had graduated.

The Rogers Building was just completed, but at a cost crippling the Institute treasury.

By 1878 more than two hundred men had graduated; and most of them were by good work in responsible posts, strengthening the reputation of the school. Two buildings had been added.

The total number of students by years was: 1868, 172; 1869, 206; 1870, 224; 1871, 261; 1872, 348; 1873, 276; 1874, 248; 1875, 255; 1876, 215; 1877, 194. It will be borne in mind that the panic of 1873 caused a general falling off in college attendance. President Runkle was confronted at the outset by the pressure of over-rapid growth, then by discouraging decline.

The more notable events of the Runkle presidency were: the futile negotiations, already referred to, with Harvard University for a union; the establishment of the laboratories of mining engineering and metallurgy; the introduction of shop instruction and the foundation of the School of Mechanic Arts; the development of professional summer schools in the field; the beginnings of an engineering laboratory; the increased efficiency of military instruction and the summer encampment at Philadelphia in 1876; the erection of a gymnasium, including a lunch-room; the admission of women as students.

The printed records for this period, 1871–1877, are particularly complete, the President's Reports including also extended departmental reports; and from these in their order the following notes are mainly taken. Some of the

expressions, now time-honored, have in their original context a surprising freshness in the obvious novelty of the ideas presented.

In 1872 announcement is made of the first field excursion for students in Civil Engineering, with the statement, "We hope to do this summer for bridge construction what was done in the last for Mining Engineering and Metallurgy."

In the previous year, President Runkle had conducted an expedition to Colorado and Utah for the observation of mines and mining processes. The party consisted of five professors and fifteen students. Much valuable information and important contributions of ore were received.

It was during this excursion, while observing the wrecks of fortunes strown all over the territories, that the thought occurred to us that much of this waste was due to a want of practical skill joined with scientific knowledge, and that the opportunity for experimenting upon comparatively large quantities of ores must be furnished to our students during their course, as a part of their laboratory work. After disbanding the party I visited San Francisco, and had the good fortune to make the acquaintance of some skilful practical metallurgists, who were making the examination of ores a specialty, and had built up laboratories for ore-dressing, on about the scale we needed. But the processes were detached, and no attempt was made to represent the best forms and kinds of machinery in use at that time in California for the reduction of gold and silver ores. . . .

The furnaces in the Metallurgical laboratory were designed by Professor Ordway and built under his direction, while the Mining laboratory has reached its present state of progress almost entirely through the ability, practical skill, and untiring energy of Professor Richards. Thus, what was a conviction has become a practical reality.

Announcement is made of the intention of Mr. John

Amory Lowell, trustee of the Lowell Institute, to establish courses of instruction in Designing, as applied to the Industrial Arts.

It is stated that, if the new class is likely to exceed one hundred, it will involve the necessity of considering the erection of a new building. This first President's Report closes with a brief statement of the resources of the Institute up to that time, showing cash gifts received to the amount of nearly $600,000, the chief benefactors being William J. Walker and Ralph Huntington. The name of the former was given to the professorship afterwards held by Dr. Runkle, that of the latter to the "great hall" of the Rogers Building.

In June, 1871, it had been

Voted, That the Corporation will hereafter confer the degree of Bachelor of Science in the department of ———, instead of graduate of the Massachusetts Institute of Technology in the department of ———, as heretofore.

To establish advanced courses of study, and to confer the degree of Doctor of Science.

In the departmental reports of 1872 it is stated that the chemical laboratory covered 4,000 square feet; the mining laboratories, 2,000 square feet; the physical laboratory, 3,500; and the drawing-rooms, 8,500. (The present chemical laboratories occupy some 30,000 square feet.)

The Report for 1873 mentions the success of an application to the legislature for additional land * on the Back Bay, and the more complete equipment of the mining and metallurgical laboratories. The preliminary announcement of the Lowell School of Design is quoted, and reference is made to the appointment of Lieutenant Zalinski, and of

* A trapezoidal lot at the junction of Boylston Street and Huntington Avenue.

Professor Whitaker as Professor Watson's successor as head of the Department of Mechanical Engineering. The President states that he has "asked Professor Whitaker to suggest such a laboratory as will best aid in the education of mechanical engineers, and particularly in the solution of those experimental problems which lie at the foundation of all safe theory or practice." He expresses the earnest wish that the Corporation will authorize the establishment of this laboratory at as early a day as possible. The expectation is stated that the elements of mechanical and free-hand drawing may be required for admission at a time not far distant.

The statistics for these years indicate a notably high proportion of Massachusetts students, usually about five-sixths of the whole.

In December, 1872, solid geometry and the rudiments of French were added to the requirements for admission, and the fee was advanced to $200 a year. The use of the large hall was granted to Trinity Church for a place of worship.

As to English, Professor Atkinson's successive reports are interesting and instructive. For example, in 1873 he says what is in great measure true in 1902 : —

> Practically a large majority of our regular students have to crowd four-and-a-half to five years' mathematical and scientific work into four years; and this leaves but a small amount of mental energy to be devoted to studies not strictly professional. There is one, and only one remedy for this difficulty, and that is a better preparation; and that not more, or even so much in English and mathematical as in elementary scientific study. In consequence of the very defective condition of school instruction in science in this country, our students have practically to begin the study of the very rudiments of physics, chemistry and the different

branches of natural history at the age of sixteen or seventeen, a period of life at which, if our schools were perfectly organized, these elements would all have been acquired.

Lieutenant Zalinski's report of the same year contains an urgent recommendation for the construction of a drill-hall and gymnasium, and refers to the beneficial effect of the trial of a student by a court-martial composed of his fellow-students for "disobedience of orders" and for "conduct unbecoming a gentleman."

In 1873 the attendance of students declined sharply, in consequence of the occurrence of a general financial crisis at the same time with advances in the tuition fee and in entrance requirements. Nevertheless, the Report for 1874 does not fail to reiterate the need of additional space and of the development of new lines of work. Announcement is made of the differentiation of courses at the beginning of the second year, and of the establishment of new courses in metallurgy, in physics, and in philosophy. It is stated that graduates have for the first time been able to present their theses before the final examinations — instead of at some indefinite later date. Undeterred by diminished numbers, the President urges the further advance of entrance requirements to include more algebra, and plane and spherical trigonometry, and emphasizes the need of laboratory instruction in elementary chemistry in every secondary school. As to English,—

An occasional exercise in composition is not sufficient. An exercise in writing, in some form or other, should be the one never to be omitted for a single day, until, first, accuracy, and second, facility of expression have been acquired.

The erection is reported of

an excellent building, 155 feet long by 50 feet in width, and one story in height, covered with corrugated iron and a slated roof, containing a light and well ventilated drill-hall, with ample space for gun-racks, wardrobes for uniforms, and boxes for those who use the gymnasium.

Where the health of one student is injured simply by over study, the health of many is injured by want of exercise, or other preventable causes, while over study is usually the only cause assigned. It is true that each class hears an excellent course of lectures on Physiology and Hygiene, but it is to be feared that too few make a personal application of what is taught them, and thus fail to gain what this instruction is mainly intended to impart. I am deeply impressed with the conviction that a radical change in this department is necessary, and that the laboratory system is quite as important in this as in other departments of the school. To make the instruction of the greatest value to each student it must be applied practically in each case; and while I am not now prepared to advocate a compulsory system of gymnastics, I am satisfied that incalculable good would come from a more personal application of the instruction, with opportunities for systematic exercise, under the direction, not of a mere gymnast, but of a physician who had made this application a matter of special study. If our students lived in dormitories, as at most colleges, or so near each other that their spare time could be spent in out-door athletic sports, the case would be somewhat different; but there is probably hardly another school in the country where the students are so thoroughly scattered, and such exercise had, if at all, at so great disadvantage.

Our only remedy therefore, in addition to what is offered by the drill to only a portion of our students, is a gymnasium.

We have also availed ourselves of the opportunity which the drill-hall has afforded us to establish, by way of experiment, a *lunch-room*, where professors and students and

their friends can get a well-cooked and well-served dinner or lunch, as desired, at a very reasonable cost; so reasonable as to induce those who have depended upon a cold lunch to do so no longer.

In these improvements, President Runkle depended much on the energy and zeal of Lieutenant Zalinski. The analogy of all this wise solicitude for the welfare of students is singularly prophetic of our present days, when realization seems not distant. It is not strange that the Walker Memorial has enlisted the warmest interest of Professor Runkle and Captain Zalinski.

In the same year a beginning had been made of an engineering laboratory. Professor Nichols's report refers to certain chemical investigations in the service of the State which have since had so notable a development.

The Report for 1875 contains for the first time a list of the 126 alumni with present residence and occupation, "furnishing the best evidence of the estimation in which the work of the school is held by the public."

The Report for 1876 is largely occupied with matters connected with the Centennial Exhibition at Philadelphia, in particular the Institute encampment and the exhibit of the Russian system of workshop instruction. Of the former, Lieutenant Zalinski's report gives an extended account. The party started June 8, numbering more than 370,— "Corporation, Faculty, graduates, former students, students and friends of members of the Institute," — with a few ladies. The University of Pennsylvania had granted the use of its campus for Camp W. B. Rogers, the State of Massachusetts loaned the necessary camping outfit, and many courtesies were extended by residents of Philadelphia.

In establishing regulations for, and enforcing the discipline of the camp, it was the aim to have the minimum re-

striction and military work consistent with maintaining good order and securing the proper sanitary conditions necessary for the health and comfort of all. . . . The conduct of the students was exceptionally good and the subject of general commendation.

The party returned to Boston June 23.

President Runkle says,—

The organization which had been found necessary for properly carrying on the instruction of the department, was found sufficient to maintain order and cohesion in a much larger body, and the Institute, as well as all the members of the party, owe a debt of gratitude to Lieutenant Zalinski for the energy and efficiency with which the whole affair was conducted.

A great quantity of material was collected at the close of the exhibition as the nucleus for the Industrial Museum included in the original plan of the Institute.

The most important result of President Runkle's visit to Philadelphia was his quick and enthusiastic appreciation of the exhibit of Russian methods of shop instruction, and of their potential advantage to the Institute in particular, and to American education in general. Within present limits the course of events can only be briefly indicated. In a special communication to the Corporation of the Institute, after recalling the experience in laboratory instruction of the Institute and other colleges, he says: —

We went to Philadelphia, therefore, earnestly seeking for light in this as well as in all other directions, and this special report is now made to ask your attention to a fundamental, and, as I think, complete solution of this most important problem of practical mechanism for engineers. The question is simply this — Can a system of shop-work instruction be devised of sufficient range and

quality, which will not consume more time than ought to be spared from the indispensable studies?

This question has been answered triumphantly in the affirmative, and the answer comes from Russia.

In all constructions a certain limited number of typical forms are found, these forms being more or less modified, to adapt them to special constructions. These forms will also fall into groups each to be worked out in a certain way and with special tools. If, then, the student can be taught to work out these forms, each in the best way, and with the tools best adapted to the work, he will be far advanced in the skill which will make him available and useful in construction. The ideas involved in the system are, first, to entirely separate the *instruction* shops from the *construction* shops; second, to do each kind of work in its own shop; third, to equip each shop with as many places and sets of tools, and thus accommodate as many pupils as a teacher can instruct at the same time; and, fourth, to graduate the samples to be made in each shop according to some scale, that of difficulty being probably the best in practice. In short, in these preliminary instruction shops the *arts*, which find their applications in construction, are systematically taught.

In the light of the experience which Russia brings us, not only in the form of a proposed system, but proved by several years of experience in more than a single school, it seems to me that the duty of the Institute is plain. We should, without delay, complete our course in Mechanical Engineering by adding a series of instruction shops, which I earnestly recommend. The whole matter turns upon getting the proper rooms. It is already clear that there are no other difficulties which cannot readily be surmounted.

The special report includes also the recommendation of the establishment of a two years' course in practical mechanism, which was afterwards carried out in the School of Mechanic Arts.

In August, 1876, the Corporation authorized the erection of a temporary building for shopwork and advanced chemistry, covering 7,500 square feet. The funds required were contributed in part by the Massachusetts Charitable Mechanic Association, in part by the Women's Educational Association with a view to securing opportunities for women students. The Russian government authorized the duplication of its Philadelphia exhibit for the Institute. The material was received the next year, and the following votes passed by the Corporation: —

Resolved, That the Corporation of the Massachusetts Institute of Technology takes this opportunity to cordially congratulate His Imperial Highness, Prince Pierre d'Oldenbourg, that, at the Imperial Technical School of Moscow, education in the Mechanic Arts has been for the first time based upon philosophical and purely educational grounds, fully justifying for it the title of the "Russian system."

Resolved, That this Corporation hereby tenders its grateful thanks to His Imperial Highness for his most valuable gift, with the assurance that these models will be of the greatest aid in promoting Mechanic Art education not only in the school of this Institute, but in all similar schools throughout the United States.

The Report includes a review of much interest by Professor Pickering of his ten years' work in the Department of Physics, concluding: —

I cannot close this report without an acknowledgment of the aid I have received from you, Mr. President, in bringing our Laboratory into its present state of efficiency. Your confidence in its success from the very beginning, your encouragement and enthusiasm regarding its extension, and the interest you have shown in every detail, have helped, more than we have realized, to such success as we have attained. . . .

With hopes that the next decade may witness as great advances as that which is just completed, I remain,

Very respectfully yours,

EDWARD C. PICKERING,

Thayer Professor of Physics.

The final Report (1877) contains an interesting analysis of student registration for the thirteen years. The proportion of special students was far larger than now, amounting in the final year to nearly 60 per cent. The proportion of the number of graduates to the number in the corresponding entering class varied after the first year from 16 per cent. to 47 per cent. The entering classes showed great fluctuations, the figures for the years 1872–76 being 115, 68, 36, 66, 36.

The Report concludes: —

In conclusion, I will say that as a whole the school has never been in a state of higher efficiency than at the present time. Our great and pressing need is additional funds; and without immediate relief, we must either discontinue some of the departments, or cut down the salaries already too small, or more probably both. The fee for those taking the full course is $200 per annum, and it is clearly out of the question to think of increasing the income by raising the tuition. It is even now far beyond the means of many deserving students.

The value of the Institute as an agency in developing and diversifying the industries of the State can only be maintained by increasing its funds. I cannot think that the large sums which have already been contributed toward the establishment of our school, and particularly the large educational facilities and experience gathered together, shall be allowed to fail of the highest results for the want of additional means.

This proved to be a valedictory.

The severe financial difficulties of the Institute are but dimly reflected in these Reports. As early as 1874 President Runkle writes Professor Rogers of the Corporation's earnest wish to reduce expenses ; and questions of this kind continued to prove painfully insistent as years passed and attendance and resources diminished, or increased but meagrely. If the President's optimism helped him to endure the strain, it did not relieve him from most embarrassing consequences, and must at times have made it difficult if not impossible for him to avoid arousing expectations only too certain to be ultimately disappointed. In October, 1877, he writes to Professor Rogers : —

For the present year a reduction of salaries will be imperative ; and it will also be equally imperative for us to reduce our teaching expenses for the future by consolidating professorships and putting the work in fewer hands. It is this or bankruptcy, if we do not get at once from some source a large increase of our invested funds. . . . I am not at all discouraged as to the future of the Institute, but I do deeply feel for all who must suffer for the Institute's sake.

In the spring of 1878 an appeal for State aid was refused. May 31 the President communicated to Professor Rogers his intention to resign his office, and a week later addressed the following letter to the Corporation : —

Boston, June 7, 1878.

Gentlemen,— I have had the honor of serving the Institute of Technology as President of this Corporation for the past ten years.

The time has come when I feel it my duty to resign this office, which I now respectfully beg to do, my resignation to take effect at the close of the present year.

I intend to remain a member of the Corporation, and wish to retain the professorship with which you honored me at the opening of the school.

In resigning the Presidency, I wish to express my grateful thanks for the opportunity you have given me to identify myself in some small degree with the well-earned fame which the Institute enjoys in maintaining one of the leading, if not the leading technical school in this country. If permitted to retain my connection with the Institute, my earnest wish is that I may be able to serve it more efficiently in the future than I have been able to do in the past.

Again, thanking you for the cordial support you have always given me in all educational measures, I ask you now to accept my resignation without ceremony and without delay.

Very respectfully,

Your obedient servant,

J. D. Runkle.

On the same day Professor Rogers wrote to the Corporation : —

Gentlemen,— As it is out of my power to be with you to-day, and as I understand from President Runkle that he wishes his resignation to be accepted without delay, I beg to say to you that I cannot let him relinquish the position which he has filled so long and so disinterestedly without expressing my sense of the great value of his services to the Institute. Few persons know the labours and perplexities which have been involved in carrying forward the plan of the Institute to its present widely expanded activity, but all who have marked its progress will, I am sure, agree with me in a most grateful recognition of the unflagging devotion to its welfare which President Runkle has always shown, and will be assured that his zealous and disinterested labours as President of the Institute must always have an honoured place in its history.

Believe me, yours faithfully,

William B. Rogers.

Dr. Runkle was granted a year's leave of absence, afterwards extended to two. Professor Rogers accepted re-election, pending the appointment of another President, on

condition that the Corporation raise $100,000 to add to the funds of the Institute. July 13 he wrote to Professor Runkle: —

> . . . And now, dear friend, with a full heart I must bid you good-by. We have known each other and have worked together so long, and, may I not say, so affectionately, that any professions of regard from me would be out of place. I can only say, in parting with you for a time, that I shall think of you with the old regard, wishing for you all the rest and the enjoyment which you have so richly earned by your untiring labours, and hoping that, after a not too protracted stay abroad, you may come back to your friends with renewed health, and with undiminished, if not augmented zeal, in the educational work to which you have devoted yourself.
>
> Yours faithfully,
>
> William B. Rogers.

In 1880, Dr. Runkle returned with renewed health and strength. His storm-and-stress period was ended, and two fruitful years in Europe had now intervened. Still young at fifty-eight, he was to enjoy a delightful home life with the care and education of his young children, useful and honored citizenship in a suburban town, year after year of inspiring teaching, leadership in the broadening of secondary education along the lines he had earnestly followed since 1876.

Discussions of priority are seldom profitable, and are often at fault for lack of accurate definition. In the present instance no question of origination is involved. It had been President Runkle's merit to be the first to appreciate the American need of mechanic arts instruction based on principles already successfully applied in Russia. He was primarily interested in it as an invaluable addition to existing engineering courses, but he also saw clearly its great

potential significance for general secondary education, and so far as possible under pressure of other needs, demonstrated this by the inauguration of the School of Mechanic Arts, already referred to, in which boys of high-school age were offered a two years' course, including mathematics, English, French, history, mechanical and free-hand drawing, and shopwork. His visit to Europe enabled him to make a study of Continental schools of similar purpose; and the results of this study are embodied in a paper presented to the Society of Arts in April, 1881, on "Technical and Industrial Education Abroad," in an extended contribution to the Report of the Massachusetts Board of Education for 1880–81, and in a "Report on Industrial Education" in 1884. His matured convictions of the latter date are embodied in the following resolutions: —

First. The single aim of our public education should be the physical, mental, and moral training of the young, by all suitable means and agencies; and no study or discipline which is not adapted to these ends for all pupils should be introduced into our public schools and supported at the public expense.

Second. While the training of the mental faculties must always be the first and distinct aim of all education, still this training is most effective when all the senses are most fully brought into play as factors in the general process.

Third. We believe that hand instruction, no matter of what kind, if adapted to the age of the pupil and properly conducted, can be made disciplinary, and a valuable adjunct to the purely literary studies.

Fourth. We believe that a hand study, requiring not more on the average than one hour per day, can be introduced into our public schools without impairing the educational value of the studies now taught, and with no abridgment of the time now devoted to them which will not come through better methods of teaching, or on other grounds.

Fifth. We believe that a workshop, as part of the apparatus of a public school, is as desirable as a science laboratory is to the technical school or college.

Sixth. It is the deliberate opinion of this Association that the time has come when hand work should be taught to the proper extent in all our public schools, both because of its educational value, and because the social and industrial conditions have so changed as to make such teaching necessary.

Others have taken a more directly prominent share in the introduction and extension of mechanic arts or manual training in primary and secondary schools, but the actual experiment initiated by President Runkle in Boston had in its time wide influence and imitation. In Brookline, Dr. Runkle was long an active member of the school committee, and a modern school-house bears his name.

As a teacher of mathematics, Professor Runkle found his highest usefulness and most congenial vocation,— a vocation to be happily continued for not less than twenty-one years. The present writer may be permitted to recall the beginnings of an acquaintance which he has had the good fortune to enjoy from the beginning of this period. He remembers as from yesterday the (to his immature view) venerable but robust figure, the somewhat straggling locks of gray with a tawny tinge, the stimulating, luminous, unconventional exposition, the quick, incisive questioning, the surprising blackboard drawing, the inimitable touches of the confidential or the monitory, the constant substratum of uplifting earnestness and dignity. None of his students could fail to acquire admiring affection: very few could withstand the incentive to work. Which of them will not recall such characteristic expressions as this, " Now, gentlemen, I am going to show you one of the most beautiful and interesting things you ever came across?"

In 1880, Professors Runkle and Osborne were the entire mathematical staff, and nearly every student came in contact with both. As years have passed, this has greatly changed; and in recent times only a fraction of the students in calculus have met in 22 Rogers. Professor Runkle's place in the affections of the alumni has been none the less secure, and to no representative of the school have they extended more cordial invitations or more enthusiastic greetings. As a teacher, Dr. Runkle maintained his interest and zeal in a remarkable degree. In the class-room he renewed his youth. His teaching became the most vital part of his life. Until the summer of 1901 he had done full work. In the fall, feeling somewhat doubtful of his strength, he was relieved at his own request. An opportunity arising for substitute work, he was more than willing to fill it, even expressing the idea that he had made a mistake in giving up. But his earlier judgment had been well founded. His strength soon proved unequal to the task, and he was afterwards able to be at the Institute but rarely.

As a member of the Corporation and the Faculty,— and either position may prove easily embarrassing for an ex-President,— Dr. Runkle's position has been unique and his relations with his colleagues during these twenty-one years have been most fortunate. Always ready and glad to place his own experience and best judgment unreservedly at the service of his associates, his attitude has never been critical, even in implication. He frequently presided at Faculty meetings, and was long a member of the Faculty Committee on Scholarships,— a place in keeping with his unceasing interest in student welfare.

As senior member of the mathematical staff, his relations with his younger associates have been not merely friendly,

but almost paternal. In the early years the department had been too small to need formal organization. After it became larger, he was disposed to leave much initiative to his juniors; and any progressive tendencies of theirs never failed to receive his prompt appreciation and encouragement. He expressed his interest in the department by donating to it his own valuable collection, and was not a little pleased at the action of the Corporation in giving to the enlarged library his own name.

Near the end of the past school year the following letter was addressed to Professor Runkle by his colleagues of the Faculty: —

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,
Boston, May 31, 1902.

Dear Professor Runkle,— In recognition of your recent appointment as professor emeritus, we desire as your colleagues in the Faculty of the Massachusetts Institute of Technology to tender an expression of our high regard.

We remember with grateful appreciation your eminent services to the Institute from its foundation, and your warm personal interest in your students and your associates.

We trust that it may be agreeable to you, at such time as you may prefer, to give us the great pleasure of meeting us at a dinner at the Technology Club.

This pleasure was unfortunately not to be realized.

Professor Runkle was a man of much intellectual quickness and strength, of ardent, but in later years serene, temperament, of warm and generous affections, of cordial unaffected courtesy, in all the relations of life a sincere and loyal gentleman. Throughout his early and middle life he was a pioneer, first in the struggle for his own education and that of his brothers, next in the establishment and continuance of a much-needed but, as it turned out, premature

mathematical journal, then and for many years in the development of the Massachusetts Institute of Technology, and the introduction of education in the mechanic arts. In all these undertakings his insight and courage were invaluable. He made President Rogers' plans for the Institute his own. He held steadfastly to its fundamental ideals, and, taking account of his scanty resources, made remarkable progress toward their fulfilment. The main changes he initiated have been abundantly justified by time, and he has lived to see their fulfilment.

His students have been his lifelong friends, and some have had the good fortune to renew the friendship through their sons. In his declining years he has enjoyed the abundant fruition of many hopes. He has been able to continue the work he loved nearly to the end, which has come as we may believe he would have chosen. His name and memory are now added to those traditions which constitute what is permanent in the Institute of Technology.

H. W. Tyler, '84.